Claims

1. A semiconductor laser emitting at a given wavelength with a coating on its emitting facet, *wherein*

- said coating comprises an essentially amorphous SiN_x:H layer, x being a real number,

with a predetermined thickness and a predetermined refractive index,

- said thickness being determined by said laser's wavelength,
- said refractive index being essentially determined by the Si/N ratio in and/or the microstructure of said SiN_x:H layer.

2. The semiconductor laser according to claim 1, *wherein*

- the refractive index of the SiN_x:H layer is selected in relation to the refractive index of the laser facet.

3. The semiconductor laser according to claim 1, *wherein*

- the thickness, in particular optical thickness, of the coating is selected to be one quarter of the laser's wavelength.

4. The semiconductor laser according to claim 1, *wherein*

- the refractive index of the coating is tuned during the manufacturing process of the

SiN_x:H layer, essentially by controlling its Si/N ratio and/or its microstructure.

5. The semiconductor laser according to claim 4, *wherein*

- the Si/N ratio of the SiN_x:H layer is selected between approximately 0.3 and approximately 1.5.

6. The semiconductor laser according to claim 1, *wherein*

- the coating is a multi-layer coating including at least one essentially amorphous SiN_x:H layer.

7. The semiconductor laser according to claim 1, *wherein*
- the coating consists of or comprises an essentially homogeneous SiN_x:H layer.

8. The semiconductor laser according to claim 7, *wherein*
- the ratio of Si to N of the SiN_x:H layer is tuned to effect a refractive index of the coating close to $\sqrt{n_{eff}}$, wherein n_{eff} is the effective refractive index of the laser facet.

9. The semiconductor laser according to claim 7, wherein
- the refractive index of the SiNx:H layer is tuned to achieve a refractive index of the coating between approximately 1.6 and approximately 2.4.

10. The semiconductor laser according to claim 7, wherein
- the refractive index of the SiNx:H layer is tuned to achieve a refractive index of the coating between 1.79 and 2.24.

11. The semiconductor laser according to claim 7, wherein
- the SiN_x:H layer is located adjacent the laser facet and its refractive index is tuned to effect a reflectivity at the laser facet of approximately zero.

12. The semiconductor laser according to claim 7, wherein
- the coating constitutes a phase-shifting QW coating.

13. The semiconductor laser according to claim 7, *wherein*
- the Si/N ratio of the SiN_x:H layer is selected between approximately 0.3 and approximately 1.5.

14. The semiconductor laser according to claim 7, *wherein*
- the optical thickness of the SiN_x:H layer is selected to be one quarter of the laser's wavelength.

15. A coating on a facet of a semiconductor laser emitting at a given wavelength, said laser having an external cavity, *wherein*

- said coating comprises or consists of an essentially amorphous SiN_x:H layer, wherein x is a real number,
- said SiN_x:H layer having
    - a thickness determined by said laser's wavelength, and
    - a refractive index essentially determined by the Si/N ratio in said SiNx:H layer.

16. The coating according to claim 15, *wherein*

- the refractive index of the SiN_x:H layer is further determined by the microstructure of said layer.

17. The coating according to claim 16, *wherein*

- the Si/N ratio and/or the microstructure of the SiN_x:H layer is selected to produce a refractive index of said coating close to $\sqrt{n_{eff}}$, n_{eff} being the effective refractive index of the laser facet.

18. The coating according to claim 15, *wherein*

- the Si/N ratio of the SiN_x:H layer is selected between approximately 0.3 and approximately 1.5.

19. The coating according to claim 15, *wherein*

- the optical thickness of the SiN_x:H layer is selected to be one quarter of the laser's wavelength.

20. A GaAs/GaAlAs-based semiconductor laser emitting radiation with a wavelength λ between about 600 and about 1100 nm, *comprising*

- a coating on a facet of said laser, said coating including or essentially consisting of

an SiN_x:H layer with a refractive index between 1.79 and 2.24 and a thickness of about $\lambda/(4n)$, n being the refractive index of said laser facet.

21. An InP-based semiconductor laser emitting radiation with a wavelength λ between about 1300 and about 1600, *comprising*

- a coating on a facet of said laser, said coating including or essentially consisting of

an SiN_x:H layer with a refractive index between 1.79 and 2.24 and a thickness of about $\lambda/(4n)$, n being the refractive index of said laser facet.

22. An optical transmitter or amplifier with an input and an output and optical means therebetween, said optical means comprising:

- a semiconductor laser emitting at a given wavelength and having a coating on its emitting facet,
- said coating including an amorphous SiN_x:H layer, wherein x is a real number, with a predetermined thickness and a predetermined refractive index,
- said thickness being determined by said laser's wavelength,
- said refractive index being a function of said laser's refractive index and being adjusted by the Si/N ratio in and/or the microstructure of said SiN_x:H layer.

23. The optical transmitter/amplifier according to claim 22, *wherein*

- the Si/N ratio of the SiN_x:H layer is selected between approximately 0.3 and approximately 1.5.

24. The optical transmitter/amplifier according to claim 22, *wherein*

- the coating consists of or comprises an essentially amorphous SiN_x:H layer, and
- the optical thickness of the coating is one quarter of the laser's wavelength.

25. The optical transmitter/amplifier according to claim 24, *wherein*

- the laser comprises an external cavity, and
- the Si/N ratio and/or the microstructure of the SiN_x:H layer is chosen to produce a refractive index close to $\sqrt{n_{eff}}$, n_{eff} being the refractive index of the laser's emitting facet.

26. The optical transmitter/amplifier according to claim 22, *wherein*

- the semiconductor laser is GaAs-based, emitting radiation at a wavelength λ between about 600 and 1100 nm, and
- the coating consists of or comprises an SiN_x:H layer with a refractive index between 1.79 and 2.24 and a thickness of about $\lambda/(4n)$.

27. The optical transmitter/amplifier according to claim 20, *wherein*

- the semiconductor laser is InP-based, emitting radiation at a wavelength λ between about 1300 and 1600 nm, and
- the coating consists or comprises an SiN_x:H layer with a refractive index between 1.79 and 2.24 and a thickness of about $\lambda/(4n)$.

28. An air-packaged optical unit with at least one input and at least one output and optical means between each said input and one or more of said outputs, said optical means comprising:

- a semiconductor laser emitting at a given wavelength and having a coating on its emitting facet,
- said coating including or essentially consisting of an SiN_x:H layer, wherein x is a real number, with a predetermined thickness and a predetermined refractive index,
- said thickness being determined by said laser's wavelength,
- said refractive index being determined by the ratio of Si to N in and/or the microstructure of said SiNx:H layer.

29. The optical unit according to claim 28, *wherein*

- the SiN_x:H layer is essentially homogeneous,
- the optical thickness of said SiN_x:H layer is one quarter of the laser's wavelength, and
- the refractive index of said SiN_x:H layer close to $\sqrt{n_{eff}}$, n_{eff} being the refractive index of the laser's emitting facet.

30. The optical unit according to claim 28, *wherein*

- the SiN_x:H layer is homogeneous,
- the optical thickness of said SiN_x:H layer is one quarter of the laser's wavelength, and
- the refractive index of said SiN_x:H layer is between 1.79 and 2.24.

31. The optical unit according to claim 28, *wherein*

- the semiconductor laser is GaAs-based, emitting radiation at a wavelength λ between about 600 and 1100 nm, and
- the coating consists essentially of an SiN_x:H layer with a thickness of about $\lambda/(4n)$ and a refractive index between 1.79 and 2.24.

32. The optical unit according to claim 28, *wherein*

- the semiconductor laser is InP-based, emitting radiation at a wavelength λ between about 1300 and 1600 nm, and
- the coating consists essentially of an SiN_x:H layer with a thickness of about $\lambda/(4n)$ and a refractive index between 1.79 and 2.24.

33. A method for manufacturing a coating on a facet of a semiconductor laser emitting at a given wavelength, *wherein*

- said coating includes or essentially consists of SiN_x:H,
- said coating is applied to said laser facet by a deposition process,
- said coating is deposited with
    - a predetermined thickness, and/or
    - a predetermined refractive index,
- said thickness being a fraction of said laser's wavelength,
- said refractive index depending on said laser facet's refractive index and being tuned by varying said deposition process, in particular by modifying the ratio of Si to N in said SiN_x:H layer during said deposition process.

34. The method according to claim 33, *wherein*

- the deposition process is adjusted to affect the microstructure of the SiN_x:H layer.

35. The method according to claim 33, *wherein*
- the deposition process is a PE-CVD process.

36. The method according to claim 33, *wherein*
- the deposition process is controlled to achieve an Si/N ratio in the SiN_x:H layer between 0.3 and 1.5.

37. The method according to claim 34, wherein the desired Si/N ratio and/or microstructure of the SiN_x:H layer is achieved by controlling at least one of the following process parameters in a PE-CVD process:
- one or more of the gaseous components in the plasma and its relative ratio in said plasma,
- the power of said plasma,
- the pressure in the plasma chamber, and
- the temperature of the laser substrate.

38. The method according to claim 37, *wherein*
the controlled process parameters of the PE-CVD process further include:
- the total flux of the gaseous components and/or
- the addition of H as precursor gas.

39. The method according to claim 37, *wherein*
- the gaseous components in the plasma include at least one from the following group: nitrogen, ammonia, and silane, whose relative ratios in said plasma are determined by their respective flux rates,
- the power of said plasma is 10-50 W, preferably 25 W,
- the pressure in the plasma chamber is 1-2 Torr, preferably 1,4 Torr, and
- the temperature of the laser substrate is 150-400°C, preferably 300°C.

40. The method according to claim 39, *wherein*
to achieve a desired refractive index of 1.79-2.24 of the SiN_x:H layer,

- the nitrogen flux rate is selected to be 20-50 sccm, preferably 35 sccm,
- the ammonia flux rate is selected to be 5-20 sccm, preferably between 8,5 and 18 sccm, and
- the silane flux rate is selected to be 4-12 sccm, preferably between 4.72 and 9.82 sccm.